The Commercial IMTA and Future Seaweed Biofilter Potential in Denmark

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THE COMMERCIAL IMTA AND FUTURE SEAWEED BIOFILTER POTENTIAL IN DENMARK

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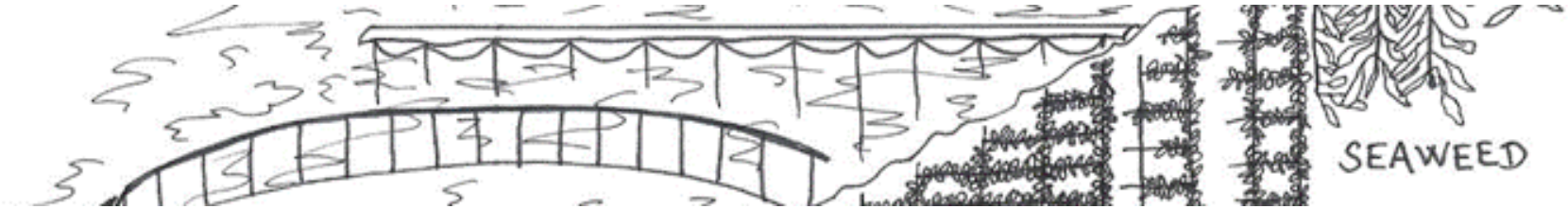
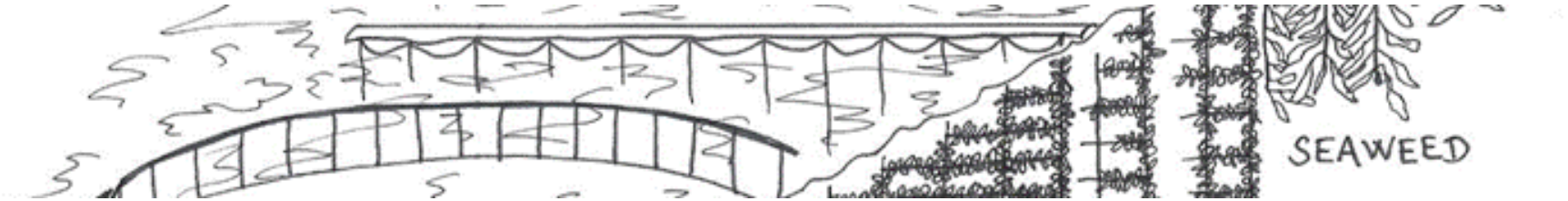


Objectives

- Nitrogen and regulations in DK
- IMTA
- Cast seaweed
- Seaweed for waste water bioremediation
- Future perspectives

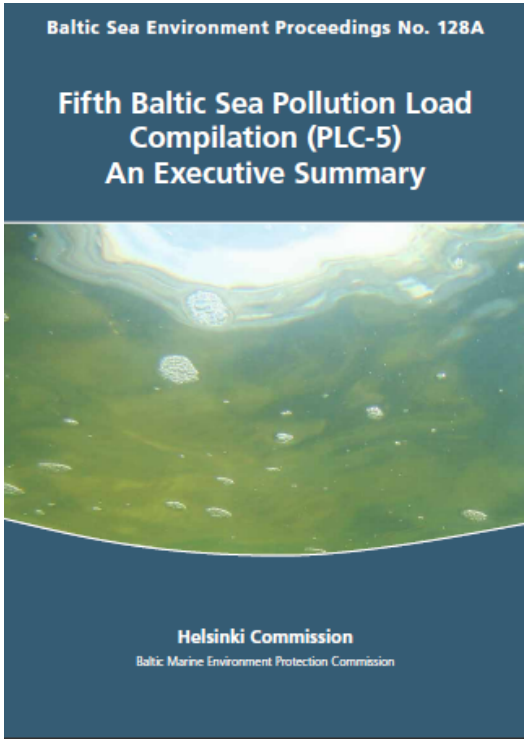


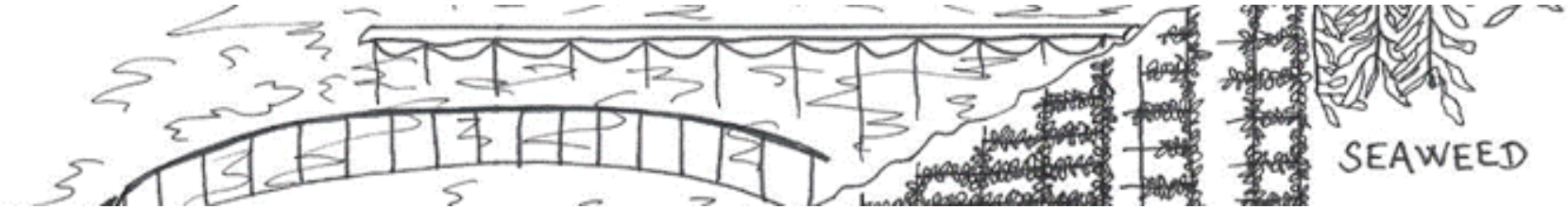
Intro

Danish sea territory 100,000 km^2

Total Danish N loading

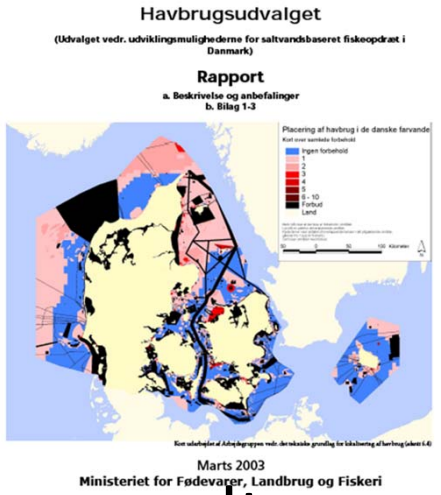
- 43,000 t/year
  - the terrestial input is the main contributor
- 350 t/year from marine farms
  - Environmental concern





Restrictions

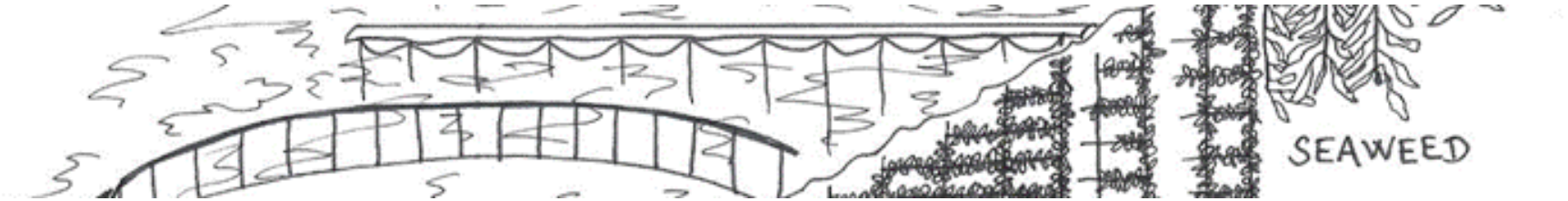
- Generally the water areas are not allowed to increase their N outputs
- EU Water framework directive
- The new aquaculture strategy has just ended the public hearing period
  - propose 50% increase in Danish aquaculture with best available technologies (BAT) (2020)
  - the use of biofilter (mussels and seaweed)



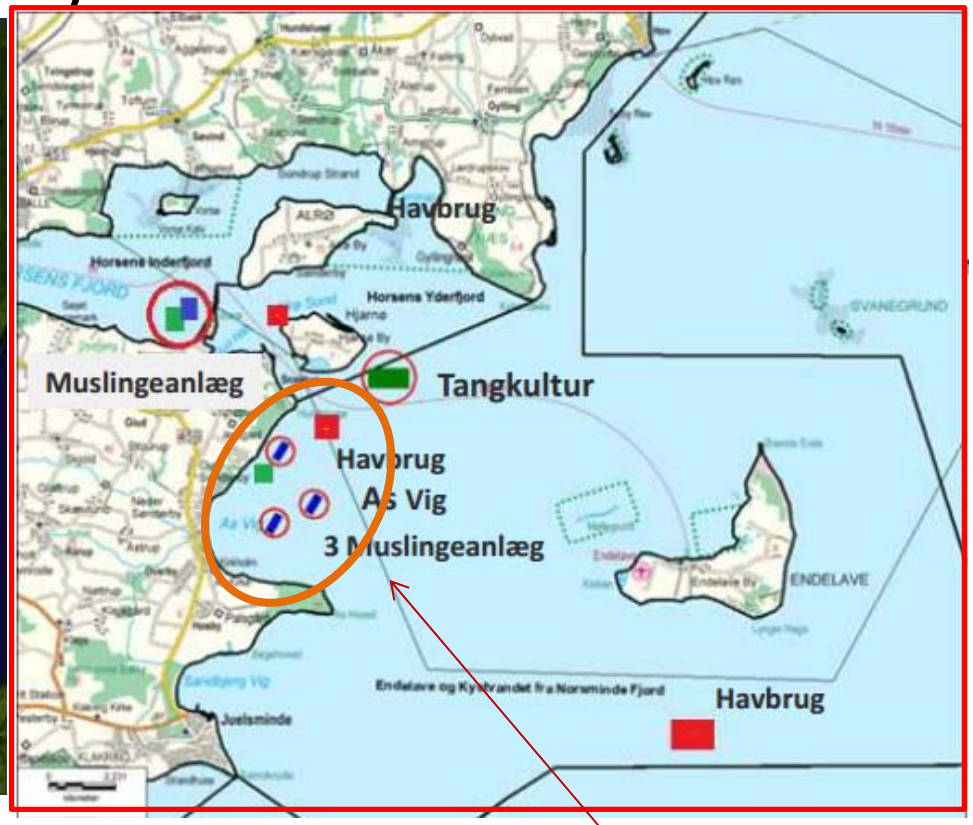
Integrated Multi-trophic Aquaculture (IMTA)

- Hjarnø fishfarm commercial scale IMTA
- 27 people fully employed (20 x-tra Oct-Jan)
- Rainbow trout production 175 t/y
- 35 SmartFarms (harvest 2012: 143 t)
- 10 km of *Saccharina latissima* droppers

- Organic certified seaweed at 'reference site' (100 ha)

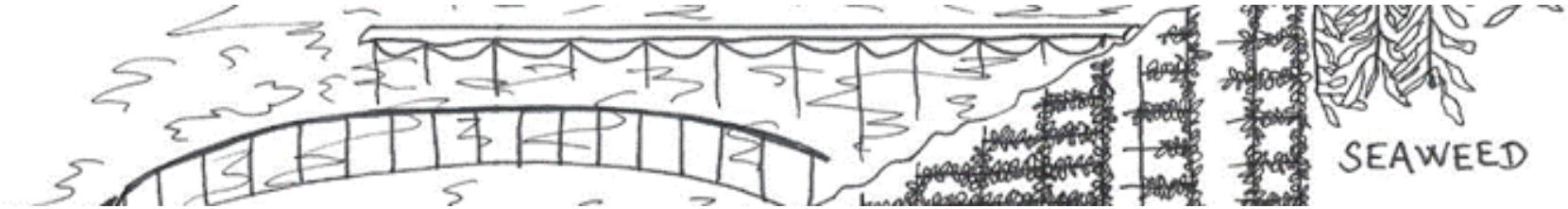


- IMTA (Hjarnø fishfarm)

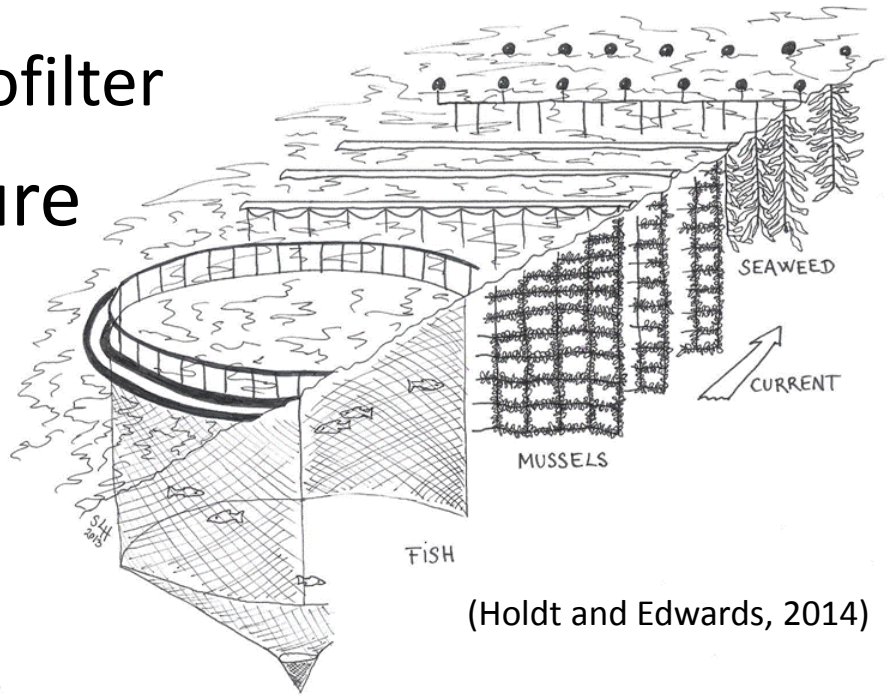


Fish farm Seaweed farm Mussel farm

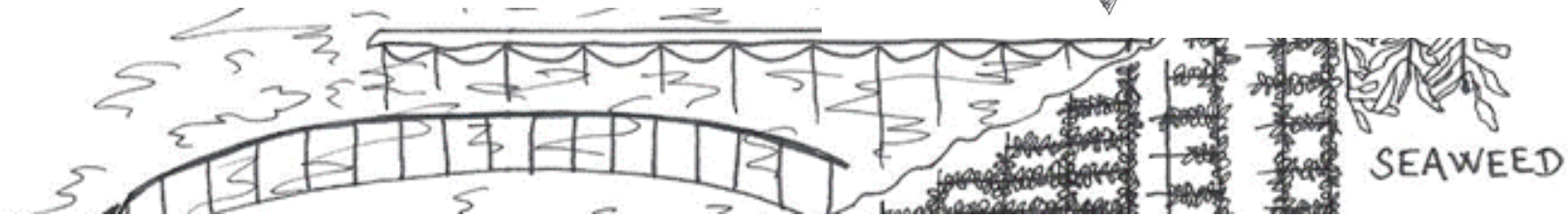
IMTA



- Compensation study/combined cultivation
  - Document the biofilter effiency (N and P uptake)
- New facility, 2,200 ton rainbow trout
  - Zero N output
  - Mussel and seaweed biofilter
- Decoupled - > polyculture



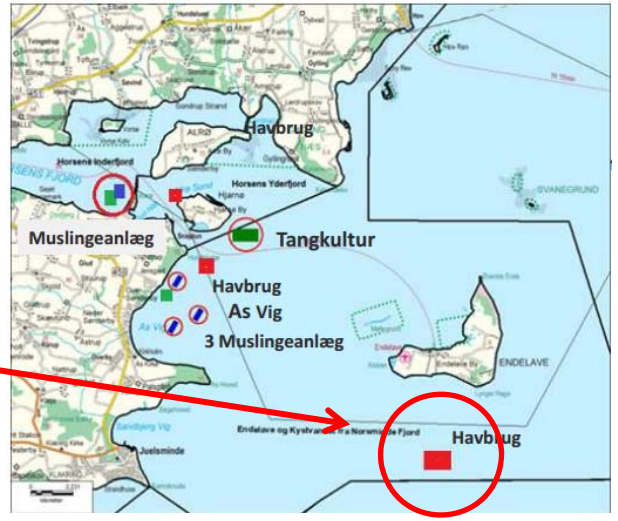
(Holdt and Edwards, 2014)



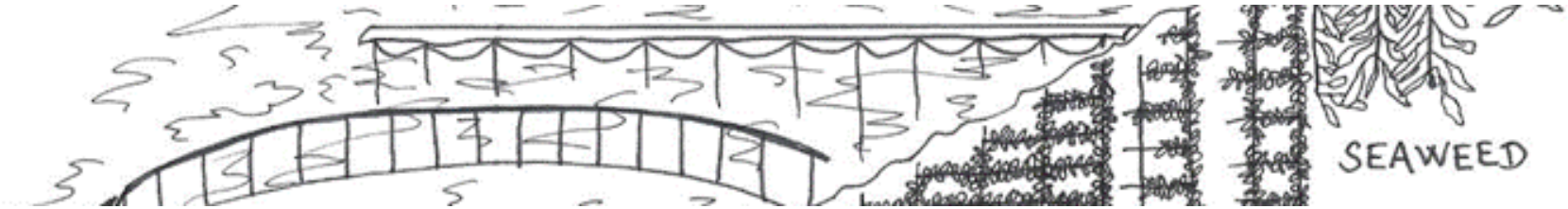
Scenario/frame for the new facility in 2016:

– (Now only 50 t juvenile equivalent to harvest 200 t fish)

- Fish: 2,200 t/year: 80 t N release
- Seaweed: 700 t WW/year
- (0.5% N =2.8 t N removal)
- Mussels: 8,000 t WW/year
- (1.3 % N =104 t N removal)



Biofilter at the 'old' cultivation sites near the coast

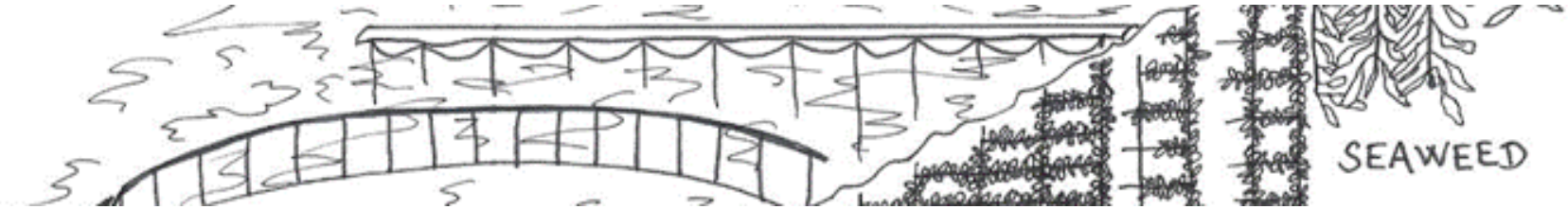


Cast seaweed at the beach

- The Solrød beach example

Eelgrass

Ectocarpus and *Pylaiella*

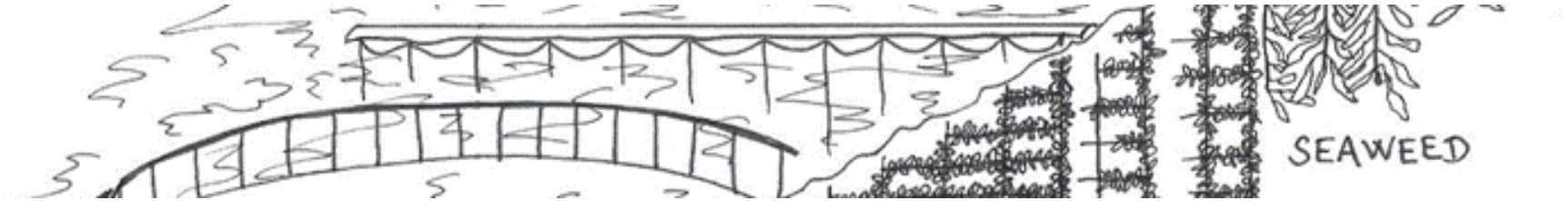


Cast seaweed harvest

- 20,000 tonnes (incl. sand)/y
- 130,000-190,000 US$/y
- 6 km coast line in Solrød
- Fertilizer for turfs

Reducing the N and P

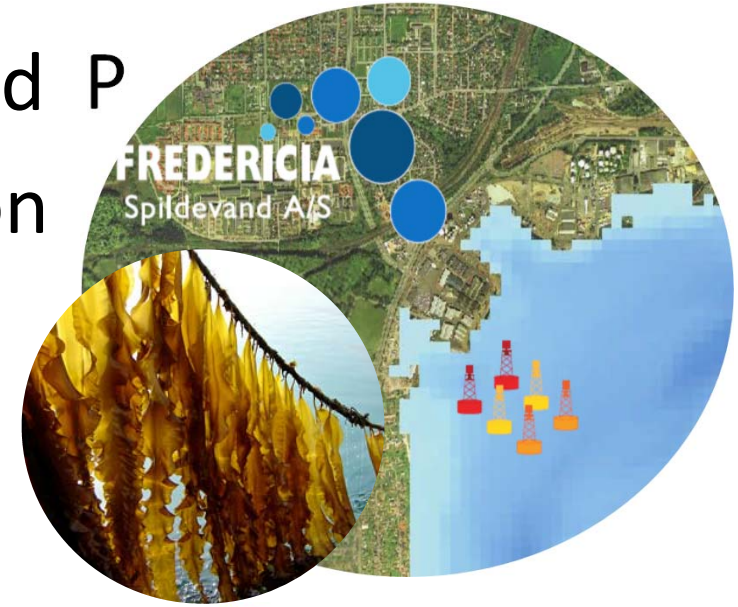
- Not recognized officially by the govt. authorities
- But considered in the region and plans



Seaweed as waste water biofilter (project)

(kindly provided by Annette Bruhn, Aarhus University)

- Municipial waste water
- Demonstrate reuse of N and P
- Include in biogas production
- Evaluation of the sludge
- Economy…



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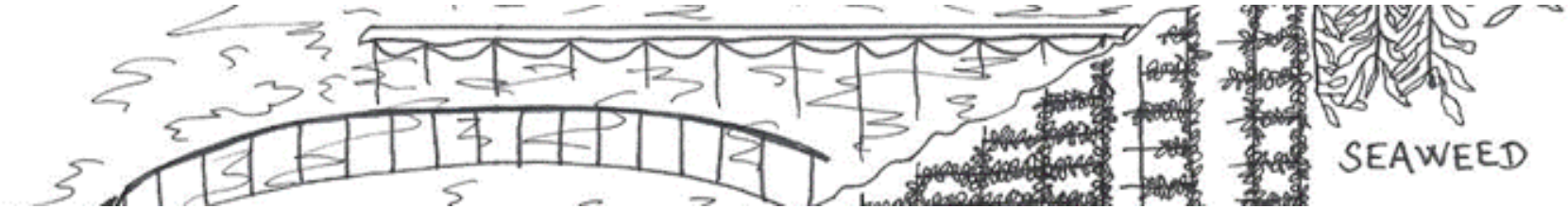
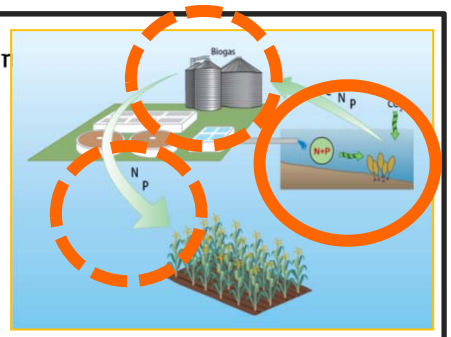
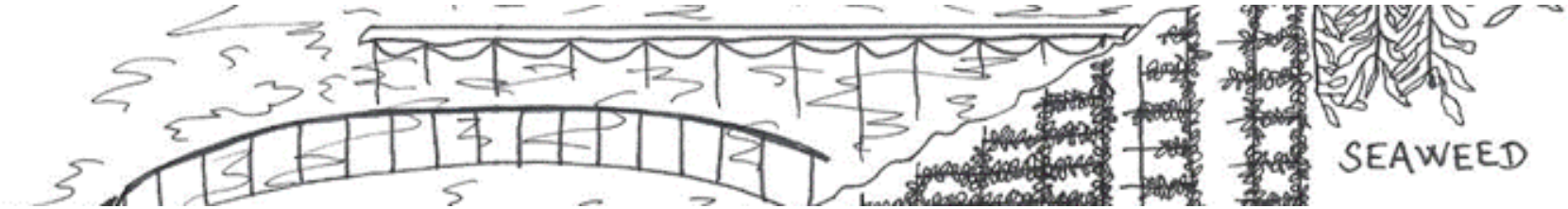




- Seaweed biomass (sugarkelps) grew
  - Highest N conc closest to WWT plant
- Biogas and sludge
  - Less than 1 ppm so no changes recorded
- Economy perspectives
  - Save 225,000 US$ if all N removed!

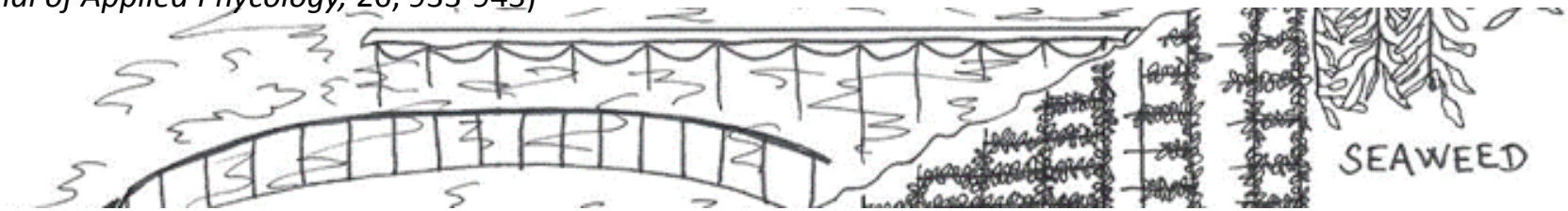
	Release (T / år)	Seaweed (% DW)	Biomass (DW)	Recover (%)	Area (ha)	Fee (US$/kg)	Fee Saving US$
N	60	3	**2,000**	100	**400**	**4**	**225,000**
P	8	0.18	4,444	45		20	75,000
C	190	33	576	347			



Future perspectives

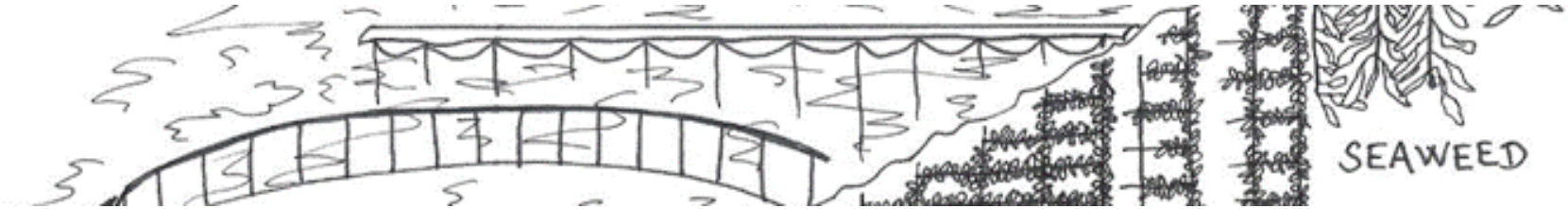
- Seaweed cultivations are recognized as biofilter in Denmark
  - This incl. decoupling
  - However, lower N content than mussel *
  - Hatchery time *
  - Mussels are subject to eiders *
- N-qota: Means that more interest from other fish farmers

(*Holdt, S.L., Edwards, M.D. (2014) Cost effective IMTA: Comparison between seaweed and mussel biofilter. *J ournal of Applied Phycology,* 26, 933-945)



Future (continued)

- New aquaculture strategy suggest to increase all Danish aquaculture by 50%.
  - New inshore farms must compensate 100% for N and P
  - New large farms are proposed to 'really' move off shore/off coast
- Possible that seaweed (and mussel) will be incl. in BAT
  - More economical feasibility studies are needed
- Cast seaweed biomass removal may be 'real' N-qota in the future
- Extra bioremediation of nutrients by seaweed near WWT plants may be feasible



Thanks to:

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Projektdeltager

- Hjarnø Havbrug
- Dansk Akvakultur
- Orbicon
- DTU-Miljø
- DHI
- TripleNine 999
- Seaweed Seed Supply

hjarnøhavbrug
...fish farming since 1952

gudp

GUDP – Grønt udviklings- og demonstrationsprogram

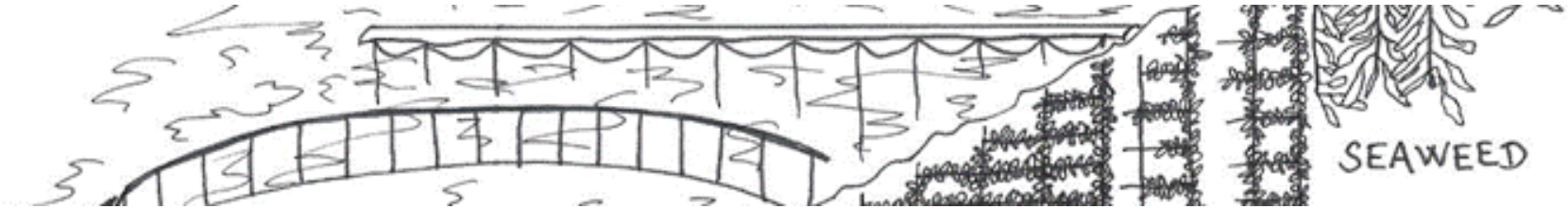
ORBICON

Member of TripleNine Group
TripleNine Fish Protein

Dansk Akvakultur

DHI

DTU



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